U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Consolea corallicola* (Small) *Opuntia corallicola* (Small) Werdermann

COMMON NAME: Florida semaphore cactus

LEAD REGION: 4

INFORMATION CURRENT AS OF: October 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X_ Continuing candidate

__ Non-petitioned

_X_ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_ 12-month warranted but precluded - FR date:

_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): October 25, 1999

___ Candidate removal: Former LP: ___

___ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F - Range is no longer a U.S. territory.

___ I - Insufficient information exists on biological vulnerability and threats to support listing.

___ M - Taxon mistakenly included in past notice of review.

___ N - Taxon may not meet the Act's definition of "species."

___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Cactaceae, Cactus Family

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, U.S.A.

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, Monroe and Miami-Dade Counties, U.S.A.

LAND OWNERSHIP: *Consolea corallicola* consists of two naturally occurring populations and a few outplanted populations. The Nature Conservancy owns and maintains the Torchwood Hammock Preserve on Little Torch Key where a small population of *C. corallicola* occurs. The second larger, naturally occurring population occurs on a key in Biscayne National Park. In 1996 an outplanting of 96 small, new cacti derived from fallen pads was performed on an undisclosed island in the lower Florida Keys. A total of 4 outplantings (170 plants) at 5 different locations have occurred at the Dagny Johnson Key Largo Hammock Botanical State Park on North Key Largo. In 2000 6 outplantings (40 plants/key) were attempted on 6 separate lower keys on Federal and State lands. No populations on other State, local, or private lands have been identified.

LEAD REGION CONTACT : Richard Gooch, 404-679-7124

LEAD FIELD OFFICE CONTACT: South Florida Ecological Services Office, Britta Muiznieks, 305-453-3777

BIOLOGICAL INFORMATION:

Species Description: The Florida semaphore cactus is an erect, trunk-forming cactus endemic to the Florida Keys. The branches usually grow in one or multiple planes from the trunk. They are copiously spiny and the spines are not barbed. Flowers are orange turning red with age (Bradley and Gann 1999) and fruits are yellow (Wright and Maschinski 2004). Unfertilized flowers revert

to a vegetative branch or drop as a dispersal unit (Wright and Maschinski 2004).

Two distinct flower morphs have been identified from plants in the *ex situ* collection maintained at Fairchild Tropical Garden and in Torchwood Hammock Preserve. The primary flowers, produced along the margin of the cladodes, are morphologically and superficially hermaphroditic (i.e., the primary sex characters, stamens and carpels are expressed). Numerous secondary flowers originate from aborted pericarpels that remain attached to the plant. These morphs bear viable pollen grains but the majority lack a gynoecium. In both morphs the anthers develop normally and produce viable pollen grains. The ovules of the primary flowers complete development but the majority exhibit abortion prior to anthesis. Most pericarpels abscise without initiation of fruits (Negrón-Ortiz and Strittmatter 2004).

Floral morphology indicates that this species is hermaphroditic with perfect flowers (i.e., each flower produces pollen and ovules). The population at The Nature Conservancy's Torchwood Hammock Preserve on Little Torch Key is thought to be cryptically dioecious (i.e. the functional unisexual morphs appear to have perfect flowers making the dioecious condition difficult to detect). Individuals that produced viable pollen grains but never set fruit or bear a few fruits were designated as males. The extant population on Little Torch Key is therefore believed to be comprised of two sexual morphs: males and weak hermaphrodites. The female sexual morph is absent from the population on Little Torch Key. A recent study by Cariaga et al. (in press), found no genetic diversity within the 2 wild populations. The results were consistent with previous reproductive biology studies that suggested that C. corallicola does not propagate sexually and that asexual reproduction is the main life-history strategy of this species.

Taxonomy: John Kunkel Small discovered this cactus and named it *Consolea corallicola* (Small 1930). In 1971, Long and Lakela (1971) reassigned the Florida Keys plants to *Opuntia spinosissima* Miller, a species restricted to the Blue Hills of south coastal Jamaica. In doing so, they evidently followed the views of Lyman Benson, an expert on North American cacti. Austin and Binninger (1994) found that the Florida semaphore cacti are actually not *O.* spinosissima and should properly called *O. corallicola.* Recent research shows that the Florida semaphore cactus is both morphologically and genetically unique and should be recognized as a distinct species and separated from the genus *Opuntia* into the genus, *Consolea* (Gordon and Kubisiak 1998, Austin et al 1998). Although many researchers recognize the new genus, many have been slow to incorporate the new name into documents and websites and still refer to it as *Opuntia corallicola* instead of *Consolea corallicola*.

Habitat: This cactus grows close to salt water on bare rock with a minimum of humus-soil cover in hammocks near sea level (Small 1930, Benson 1982). The plants on Little Torch Key are in a mixture of sun to shade although the adult plants in the shade appear healthier than adults in the sun. At the other naturally occurring location at Biscayne National Park, all the plants are on the edge of a hammock in partial shade.(Wright and Maschinski 2004). An experimental outplanting was conducted to determine optimal growth conditions. Plants in the shade were taller and produced fewer pads, whereas plants in the sun were shorter but developed more pads. It is believed that plants in sunny conditions experience higher salt levels than those in shady

locations and this may contribute to their stunted growth (Stiling et al. 2000).

Historical Range/Distribution: The species was discovered by John Kunkel Small on Big Pine Key in 1919 (Small 1930). By the 1960s, it was extirpated from Big Pine Key by road building and poaching (Bradley and Gann 1999, Bradley and Koop 2003). In the 1960s, a second population was discovered on Little Torch Key, an island immediately west of Big Pine Key (Bradley and Gann 1999, Gann et al. 2002, Bradley and Koop 2003). Small (1930) reported the species occurred in Key Largo in the upper Florida Keys however no reference was given as to the size or number of individuals.

Current Range/Distribution: Until 2001, *C. corallicola* was known only from a single wild population on Little Torch Key, comprised of only a few, declining, mature plants at The Nature Conservancy's Torchwood Hammock Preserve. Ninety-six cacti were outplanted in an undisclosed location in the lower keys in 1996. By the end of the study in November 1998 there were few signs of growth and a 34.4% decline in the population (Stiling et al. 2000). In November of 2001, a new colony was found in Biscayne National Park (Bradley and Woodmansee 2002, Gann et al. 2002, Bradley and Koop 2003). This population is approximately 140 km from Big Pine Key (Bradley and Woodmansee 2002), the closest historically documented occurrence, and 145 km from Little Torch Key, the site of the other naturally occurring extant population (Bradley and Koop 2003). From 1996 through the present, the Dagny Johnson Key Largo Hammock Botanical State Park in North Key Largo has been outplanting (4 outplantings at 5 different locations), with varying degrees of success, pads that originated from the Little Torch Key population. Approximately 1/3 of the plants survived to 5 years. Cacti planted in the hammock (from the original outplanting in 1996) exhibited poor growth and were removed in 1999. Some mortality was documented after extremely high tides in October 2004. Out of a total 170 cacti that have been outplanted, 89 remain in the buttonwood ecotone and 75 remain in the coastal rock barren sites. At present there are 164 cacti, however this number includes recruits as well as the original plant. Another outplanting experimenting with different levels of shade and fertilizer occurred in the lower keys in 2000. Forty small cacti were outplanted on each of six keys. Mortality in this experiment was high and 108 cacti (45%) had died within 3 years.

Population Estimates/Status: The Little Torch Key population at The Nature Conservancy's Torchwood Hammock Preserve consists of 5 slowly declining, mature plants and new recruits derived from fallen pads (C. Byrd, The Natural Conservancy, pers. comm. 2005). The regeneration in this population is restricted to clonal propagation because it was believed that all remaining individuals in this population were functionally male (Negrón-Ortiz 1998). Recent work indicates that fruit and pollen production in some males suggest that the extant population at Torchwood Hammock preserve consists of males and weak hermaphrodites (Negrón-Ortiz and Strittmatter 2004). The cacti population in Biscayne National Park appears relatively stable. A 2002 survey conducted by Fairchild Tropical Garden in partnership with The Institute for Regional Conservation found 629 plants (Bradley and Koop 2003). From 1996 through the present, the Dagny Johnson Key Largo Hammock Botanical State Park in North Key Largo has been outplanting, with varying degrees of success, pads that originated from the Little Torch Key

population. Out of a total 170 cacti that have been outplanted, 89 remain in the buttonwood ecotone and 75 remain in the coastal rock barren sites. At present there are 164 cacti, however this number includes recruits as well as the original plant.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Destruction or modification of habitat as a result of development is a threat throughout the range of *C. corallicola*. Although the only known populations are protected (i.e., Biscayne National Park, The Nature Conservancy's Torchwood Hammock Preserve, Dagny Johnson Key Largo Hammock Botanical State Park and National Key Deer Refuge), habitat throughout the former range is under intense development pressure. Residential and commercial development and roadway construction are occurring throughout Miami-Dade and Monroe Counties, and specifically in the Keys. In addition, the threat from modification of habitat through hurricanes or wildlife still exists at the protected sites.

B. Overutilization for commercial, recreational, scientific, or educational purposes. Collecting by cactus hobbyists may have eliminated the species from Big Pine Key and Key Largo in the late 1970s. Although the remaining wild populations on little Torch Key and Biscayne National Park, and the outplanted populations in Key Largo and the lower keys, are somewhat protected, the plants are still vulnerable to illegal collection and vandalism.

C. Disease or predation. *C. corallicola* is threatened by an exotic moth native to South America whose larvae burrow into the cactus pad and feed on the tissue. The moth, *Cactoblastis cactorum* was introduced with spectacular success into Australia from Argentina in 1925, to control several North and South American species of *Consolea* (Habeck and Bennett 1990). The moth was introduced into several Caribbean islands from 1957 to 1970 and subsequently spread throughout the Caribbean and the Florida Keys to as far north as Key Biscayne (Habeck and Bennett 1990). The first moth was encountered in the Florida Keys in 1989. It has since spread up the Florida coast and may eventually threaten prickly pears in the southwestern United States and Mexico. *Cactoblastis* rapidly infested many Florida cacti, with up to 60% of the common *Opuntia stricta* plants attacked, and many individuals completely destroyed (Stiling 2000). As a precaution, all remaining adult plants of *C. corallicola* at the Torchwood Hammock Preserve were placed in screen cages in 1990. For various reasons (e.g., pollination, dispersal, hurricanes), the cages have since been removed and the cacti are checked for moth larvae on a 4-6 week rotation (more frequently after hurricanes) (C. Byrd, pers. comm.2005). *Cactoblastis* moths have recently devastated the population of *C. nashii* on Andros Island in the Bahamas (V. Negrón-Ortiz, Miami University, pers. comm. 2002). At this time, the threat from predation from *Cactoblastis cactorum* is considered urgent and significant.

D. The inadequacy of existing regulatory mechanisms. The Florida Department of Agriculture and Consumer Services designated the Florida semaphore cactus under the name of *Opuntia spinosissima* as endangered under the Chapter 5B-40, Florida Administrative Code. This listing regulated commercial trade but provides little or no habitat protection beyond the State's Development of Regional Impact process. This process serves to disclose impacts from projects, but provides no regulatory protection for State listed plants on private or federal lands. Without local or county ordinances preventing the destruction of the plant, conservation of the plant does not occur. Biscayne National Park is currently working with Fairchild Tropical Garden to develop a conservation plan. At present, no physical protection is provided for the plant and access is not restricted; however, the location of the plant is not made known to the general public (T. Kellison, Biscayne National Park, pers. comm. 2004). At the Dagny Johnson Key Largo Hammock Botanical State Park in North Key Largo, no additional protection above and beyond what is given to other plant species occurring on state property is given to the Florida semaphore cactus (J. Duquesnel, pers. comm. 2004).

E. Other natural or manmade factors affecting its continued existence. Hurricanes and other natural disasters can be devastating to small remnant populations, such as the few wild *C. corallicola* plants on Little Torch Key. Hurricane Georges in September 1998 had a dramatic effect on the population. Eleven plants were broken in half and lost most of their pads (D. Gordon, The Nature Conservancy, pers. comm. 1999). However, some parts of plants that landed on the soil did root, producing new plants. It is unknown whether these new individuals will survive to become adults. While the full impact of the hurricane on the plants is still being evaluated, it was definitely negative. The recent finding that the surviving individuals on Little Torch Key are either male or weak males (V. Negrón-Ortiz, pers. comm. 2002) makes this remnant population even more susceptible to natural or manmade factors.

C. corallicola is an obligate outcrossing species as are many cacti. Apparently, all plants in the Little Torch Key population carry the same self-incompatibility allele; even crosses between plants in this population produce no seeds (Negrón-Ortiz 1998). This is likely the result of genetic drift in this small population. The cactus will replicate itself vegetatively, and the best remaining means to maintain the Little Torch Key population may be human-assisted propagation.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Florida Department of Agriculture and Consumer services has been conducting research and studies on restoration since 1993 using section 6 funding. The Nature Conservancy has formulated and implemented an informal recovery strategy for this species. Fairchild Tropical Garden maintains this species in its Center for Plant Conservation living collection of endangered plants. It has also propagated plants collected from the Little Torch Key population in an effort to transplant them at Big Pine Key and Key Largo. Results of these activities have

yet to be determined. Reintroduction efforts at the National Key Deer Refuge have been unsuccessful to date (P. Frank, Service, pers. comm. 2002). Botanists at The Institute for Regional Conservation have asked the Service to consider listing the species as endangered (K. Bradley, The Institute for Regional Conservation, pers. comm. 2002

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)

C. corallicola is threatened by an exotic moth (*Cactoblastis cactorum*) native to South America whose larvae burrow into the cactus pad and feed on the tissue. *Cactoblastis* has rapidly infested many Florida cacti, with up to 60% of the common *Opuntia stricta* plants attacked, and many individuals completely destroyed (Stiling 2000). At this time, the threat from predation from *Cactoblastis cactorum* is considered urgent and significant.

In October 2005, the entire Florida Keys were affected by Hurricane Wilma. The effects of the storm on the wild and outplanted populations is currently unknown. High winds and storm surge more than likely affected the entire population.

For species that are being removed from candidate status:
___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The extant population of this cactus contains 2 wild populations and a few outplanted populations, all threatened by an exotic moth, *Cactoblastis cactorum*, introduced about 15 years ago. The threat of invasion by *C. cactorum* is high at all locations with one plant killed by *C. cactorum* larvae on Little Torch Key. Stem browning accounted for the death of 2 of the 14 mature plants and a large portion of the original outplanting attempt in the lower keys. Stem browning is possibly associated with root rot disease and may be the result of elevated soil salinity in sunny areas (Stiling et al 2000).

Imminence: All remaining populations of *C. corallicola* are under threat of predation from *Cactoblastis cactorum* moths. *C. cactorum* has already been identified at the Little Torch Key population and has infected two (of which one was killed) plants at this site (Stiling and Moon 2001). The moth has not been detected on the population in Biscayne National Park but the likelihood of it reaching this population is high based on the rapid spread of the species in the Caribbean and Florida (Bradley and Koop 2003, Mahr 2001). The extent to which root rot will be a problem in the wild and outplanted populations is yet to be determined.

Rationale for Change in Listing Priority Number (insert if appropriate):

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed

Is Emergency Listing Warranted? No. The large population at Biscayne National Park appears to be stable. The Little Torch Key population at The Nature Conservancy's Torchwood Hammock Preserve consists of 5 slowly declining, mature plants and new recruits derived from fallen pads All populations need to be monitored closely to detect *Cactoblastis cactorum* presence.

DESCRIPTION OF MONITORING

Only 5 of the original 14 mature plants currently remain in the population at The Nature Conservancy's Torchwood Hammock Preserve on Little Torch Key. Two plants at the Torchwood Hammock Preserve were infested by the *Cacotblastis cactorum* moth, killing one of them (Stiling and Moon 2001). The Nature Conservancy closely monitors this population for any new evidence of infestation. The Service contacts Conservancy personnel on an annual basis to check on the status of their population. Between August 2002 and June 2003, 586 plants were tagged and monitored on a key in Biscayne National Park. No evidence of *C. cactorum* or poaching was observed. Frequent monitoring of the Biscayne National Park population is desirable to detect *C. cactorum* infestation and poaching, however, resource availability currently dictates the frequency of monitoring. We have conducted literature searches and obtained recent and most historical documents. Since the last review, we have been in contact with species experts and pertinent land managers known to us.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: Florida

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED:

Austin, D.F. and D.M. Binninger. 1994. Final report on the endangered Florida semaphore cactus. Report to USFWS.

Austin, D. F., D. M. Binninger, and D. J. Pinkava. 1998. Uniqueness of the endangered Florida semaphore cactus (*Opuntia corallicola*). Sida 18(2):151-158.

Benson, L. 1982. The cacti of the United States and Canada. Stanford University Press, Stanford, California.

Bradley, K. A. and G. D. Gann. 1999. Status summaries of 12 rockland plant taxa in southern Florida. Report submitted to the U.S. Fish and Wildlife Service, Vero Beach, Florida. Miami: The Institute for Regional Conservation.

Bradley, K. A. and A. L. Koop. 2003. Status survey in Biscayne National Park and on Palo Alto Key, John Pennekamp Coral Reef State Park. Final report submitted by The Institute for Regional Conservation to U.S. Fish and Wildlife Service.

Bradley, K. A. and S. W. Woodmansee. 2002. A significant new population of the rare semaphore pricklypear cactus, *Opuntia corallicola* (Cactaceae). Sida (20)2:809.

Cariaga, K.A., C.E. Lewis, J. Maschinski, S.J. Wright, and J. Francisco-Ortega. In press. Patterns of genetic diversity in the critically endangered Florida Key endemic *Consolea corallicola* Small (Cactaceae): Evidence from Inter-Iimple Sequence Repeat (ISSRs) DNA Polymorphisms. Caribbean Journal of Science, Vol 41, No. 2, 000-000.

Gann, G. D., K. A. Bradley, and S. W. Woodmansee. 2002. Rare Plants of South Florida: Their History, Conservation, and Restoration. The Institute for Regional Conservation, Miami. 1,056 pages.

Gordon, D.R. and T.L. Kubisiak. 1998. RAPD analysis of the last population of a likely Florida Keys endemic cactus. Florida Scientist 62:203-210.

Habeck, D. H. and F. D. Bennett. 1990. *Cactoblastis cactorum* Berg (Lepidoptera:Pyralidae), a phycitine new to Florida. Florida Department Agriculture and Consumer Services,

Division of Plant Industry. Entomology circular No. 333.

Long, R. W. and O. Lakela. 1971. A flora of tropical Florida; a manual of the seed plants and ferns of southern peninsular Florida. University of Miami Press, Coral Gables, Florida.

Mahr, D.L. 2001. *Cactoblastis cactorum* (Lepidopters: Pyralidae) in North America: A workshop of assessment and planning. Florida Entomology 84(4):465-473.

Negrón-Ortiz, V. 1998. Reproductive biology of a rare cactus, *Opuntia spinosissima* (Cactaceae) in the Florida Keys: why is seed set very low? Sexual Plant Reproduction 11:208-212.

Negrón-Ortiz, V. and L. I. Strittmatter. 2004. Embryology of floral dimorphism and gender system in *Consolea corallicola* (Cactaceae), a rare species of the Florida Keys. Haseltonia 10:1-10.

Small, J. K. 1930. *Consolea corallicola*, Florida semaphore cactus. Addisonia 15:25-26.

Stiling, P., A. Rossi, and D. Gordon. 2000. The difficulties of single factor thinking in restoration: replanting a rare cactus in the Florida Keys. Biological Conservation 94:327-333.

Stiling, P. and D. C. Moon. 2001. Protecting rare Florida cacti from attack by the exotic cactus moth, *Cactoblastis cactorum* (Lepidoptera: Pyralidae). Florida Entomol. 84(4):506-509.

Wright, S and J. Maschinski. 2004. Conservation Action Plan *Opuntia corallicola*. From: www.fairchildgarden.org/research/conservation/CAP%20Opuntia%20cor%202004.doc. 9 pages.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: /s/ Jeffrey M. Fleming 11/16/2005
Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ August 23, 2006
Acting Director, Fish and Wildlife Service Date

Do Not Concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: October 2005

Conducted by: South Florida (Vero Beach) Field Office